

SECTION D3000

HVAC
07/02

1. D3000 GENERAL

1.1 SYSTEM DESCRIPTION

- a. Provide heating, ventilating, and air conditioning (HVAC) systems for the facility that attains the following main objectives: Occupant Comfort, Indoor Air Quality, Acceptable Noise Levels, Energy Efficiency, Reliable Operation, and Ease of Maintenance.
- b. The heating, ventilating, and air conditioning (HVAC) systems shall be

- c. [Any combination of equipment that attains these objectives, and meets the requirements outlined below, will be acceptable.]
- d. [[____], direct expansion multizone systems, direct expansion variable air volume systems, and thru-the-wall units are not acceptable.] [Economizer cycles shall not be used.]

1.2 SYSTEM REQUIREMENTS

- a. [Provide air conditioning and heating for all occupied spaces.]
- b. The indoor heating and cooling design conditions are detailed below:

	Outdoor	Indoor
Summer:	[____] °C dry bulb ([____] °F dry bulb)	23.8 °C dry bulb [(+0,-1 °C)] (75 °F dry bulb [(+0,-2 °F)])
	[____] °C wet bulb ([____] °F wet bulb)	50% RH [(+/-10%)] (50% RH [(+/-10%)])
Winter:	[____] °C dry bulb ([____] °F dry bulb)	20 °C dry bulb [(+1,-0 °C)] (68 °F dry bulb [(+2,-0 °F)])

- c. Occupancy:

Occupancy schedule for this facility is [____] a.m. to [____] p.m., [____] days a week.
- d. [Miscellaneous Loads: The contractor shall obtain miscellaneous load information through interviews with the facility users.]
- e. Zoning: Zone the HVAC system as follows:

[The HVAC system shall provide each zone with the choice of heating and cooling year round.] Each zone shall have its own control.

f. Energy Conservation Compliance: The design and construction shall meet or exceed the energy efficiency requirements of ASHRAE Standard 90.1 of 1999. [The design and construction of family housing projects shall meet or exceed the requirements of "Energy Star" standards and/or "Energy Star Labeled Home."]

[In addition to the above requirements, the design and construction shall also comply by exceeding the California Title-24 energy standard baseline or custom energy budget by at least 10%.

The more rigorous of the two analyses, Title-24 or ASHRAE 90.1 shall be applied to the design and construction of the project.]

1.3 CRITERIA

Mechanical system design and installation shall comply with SWDIV SECTION D3000TG "TECHNICAL GUIDANCE FOR HVAC SYSTEM. Adhere to the technical guide preference where applicable and as modified by this document.

SWDIV TECHNICAL GUIDANCE can be found on Southwest Division Internet homepage at

<http://www.efds.w.navy.mil/CapitalImprovements/BusinessLineServices.htm>

1.4 COMPLIANCE VERIFICATION

Compliance with the requirements will be determined by a review of the design and construction submittals and by field inspection. See Document 00911, "Project Kickoff And Design Completion", for submittal requirements. See Section 01330, "Submittal Procedures", for Submittal Descriptions (SD-xx) and requirements.

1.5 DESIGN SUBMITTALS

Design Analysis and Drawings

SD-02 Design Drawings

Equipment Schedule

HVAC plans showing all equipment, piping, and ductwork at a minimum scale of 1:100 (1/8 inch = 1')

Enlarged mechanical room plans and sections at a minimum scale of 1:50 (1/4 inch = 1')

System flow diagrams, which indicate all equipment, valves, instrumentation, and appurtenances.

Control drawings

Include a written sequence of control, mechanical flow diagram, and simple points list for each type of HVAC equipment (i.e., AHU's, chiller, etc.).

The mechanical flow drawings shall show the relative position of all individual HVAC components, inputs to the controller (temperature sensors, pressure sensors, equipment proofs, override buttons, etc.), outputs from the controller (actuators, valves, dampers, etc.), and hardwired safeties (smoke detectors, freezestats, etc.). [On the same drawings show a simple points list for each type of equipment. The points list will describe the point (supply fan status, chilled water supply temperature, chilled water valve position, etc.) and the type of point (digital output-DO, digital input-DI, analog output-AO, analog input-AI). The direct digital control

(DDC) system architecture schematic shall show the general architecture of the DDC system including controllers, communication LAN's, central workstation, etc.).

Equipment details and sections.

Fire-rated wall penetration schedule: Indicate penetration locations, partition rating, duct size and protected opening type. Identify fire damper of applicable U.L. rating through a penetration design number.

SD-05 Design Data (provide with each submittal)

Computer generated heating and air conditioning load calculations

Ventilation calculations

Air balance calculations

Energy analysis simulation program input and output reports

ASHRAE 90.1 User's Manual Compliance Documentation Forms

[California Title-24 Energy Efficiency Standards Manual Compliance Documentation Forms (For COMNAVREGSW AOR projects only or as required.)]

[Energy Star Compliance Documentation Forms (For housing projects only)]

Piping and ductwork calculations

Commissioning Plan

Specifications

Submit manufacturer's data sheets per Document 00911, "Project Kickoff And Design Completion" "Project Kickoff And Design Completion" for all items of the HVAC System if available. If manufacturer's data is unavailable, submit prescriptive construction specifications per Document 00911 to specify the quantity, characteristics, performance factors, efficiency, installation procedures, and testing and certification requirements.

1.6 CONSTRUCTION SUBMITTALS

SD-02 Shop Drawings

Wiring Diagram (Boiler) [G]

Control drawings [G]

SD-03 Product Data

Boilers, Burners and Control Equipment, Boiler Trim and Control Equipment, Stack, Breeching, and Supports

Steam Converter

Condensate Return Unit

Piping welding procedures, performance qualifications, and list of welder's names and symbols. Submit per ASME/ANSI B31.9.

Water chiller (G)

Cooling Tower

Condensing units

Piping, fittings, valves, instrumentation and appurtenances

Ductwork and accessories

Air handling equipment (AHU, variable air volume boxes, fan coil units, exhaust fans, etc.) (G)

Pumps

Mechanical insulation

Adjustable Frequency Drives

Control input and output devices, controllers, hardware, software, etc.

Independent Testing, Adjusting and Balancing (TAB) agency personnel qualifications.

TAB agency's design review report.

TAB agency's pre-field TAB engineering report.

For each product, component, and system, specified in this section that uses refrigerants, provide a statement certifying that they have an Ozone Depletion Factor (ODF) of 0.055 or less.

SD-06 Test Reports

Start-up and operational tests for the water chiller

Start-up and operational tests for the boiler

Certified TAB report [G]

Commissioning Report [G]

Performance Verification Plan [G]

Cooling Technology Institute 201 Certification of Cooling Towers

SD-07 Certificates

Certificate of Readiness.

Submit a Certificate of Readiness stating that all equipment, systems, and controls are now complete and ready for functional performance testing to begin. Completed pre-start and start-up checklists, signed by the responsible parties including the Commissioning Agent, shall support the certificate. Final system performance verification testing will not be conducted until the Certificate of Readiness is submitted to the Contracting Officer.

SD-10 Operation and Maintenance Data

After approval, by the Contracting Officer, assimilate construction submittals into the OMSI manuals required under Section 01782, "OMSI Manuals or Design Build".

Boilers

Steam Converter
Condensate Return Unit
Water chiller
Cooling Tower
Condensing units
Air handling equipment (AHU, fan coil units, exhaust fans)
Pumps
Electric motors and starters
Adjustable Frequency Drives
Final TAB Report
SD-11 Closeout Submittals
Posted operating instructions
Updated Commissioning Report

2. D3010 ENERGY SUPPLY

2.1 D3011 OIL SUPPLY SYSTEM

[Text to be developed.]

2.2. D3012 GAS SUPPLY SYSTEM

2.2.1 NATURAL GAS PIPING

Obtain natural gas pressures from the [local utility company, _____]
[Base Utilities]. The point of connection is at _____.
[Coordinate application or permit and provision of gas meter and/or pressure
regulator with local utility company]

2.2.1.1 Materials And Equipment

- 2.2.1.1.1 Aboveground Within Buildings: [Black steel] [Corrugated stainless steel tubing with polyethylene jacketing and fittings]
- 2.2.1.1.2 Underground: Polyethylene (PE) pipe. Provide [detectable aluminum for plastic backed tape] or [detectable magnetic plastic tape]
- 2.2.1.1.3 Steel Pipe Fittings: [Threaded fittings] [Butt-welding fittings]. [Flanges and flanged fittings]
- 2.2.1.1.4 Polyethylene Fittings: [Socket fittings] [Molded butt-fusion fittings]
- 2.2.1.1.5 Risers: [Remote bolt-on or bracket] [Wall mounted]
- 2.2.1.1.6 Below Ground Valves: {Metallic ball valve} [PE ball or plug valve]
- 2.2.1.1.7 Aboveground Valves:
 - a. Shut-off valves [Lockable].

- b. Pressure regulator.
 - c. [Earthquake automatic shut-off valve]
 - 2.2.1.1.8 Gas Meter. [Pipe] [Pedestal] mounted.
 - 2.2.1.1.9 Valve Box. [Heavy duty type]
 - 2.2.1.2 Natural Gas Pressure Testing and System Purging
- Pressure tests all piping system. After completing pressure test and before testing a gas contaminated line, purge line with nitrogen to remove air and gas.

2.3 D3013 COAL SUPPLY SYSTEM

[Text to be developed.]

2.4 D3014 STEAM SUPPLY SYSTEM

[For exterior buried Steam Distribution Systems see G3041.] [See D3043.]

2.5 D3015 HOT WATER SUPPLY SYSTEM

[For exterior buried Hot Water Distribution Systems see G3043.] [See D3044.]

2.6 D3016 SOLAR ENERGY SYSTEM

[Text to be developed.]

2.7 D3017 WIND ENERGY SYSTEM

[Text to be developed.]

3. D3020 HEAT GENERATING SYSTEMS

3.1 D3021 BOILERS

3.1.1 HOT WATER BOILER

- a. The boiler shall meet the requirements of the ASME, UL, NFPA, and ANSI.
- b. The construction type of boiler shall be based on the input capacity of the boiler.
- c. The boiler shall conform and shall meet the NOX and other environmental requirements of the local Air Quality Management District or Air Pollution Control District.

3.1.1.1 BOILER BURNER

Provide a natural gas-fired power burner. Burner controls, fuel train and safety equipment shall conform to ASME CSD-1. The following safety interlock switches and limit controls required by ASME CSD-1 for gas-fired burners with an input greater than 5,000,000 Btu/hr (1465 kW) shall be extended to all gas-fired burners with an input of 400,000 Btu/hr (117 kW) and greater:

- a. The safety shutdown due to loss of combustion air
- b. The safety shutdown due to high or low pressure in the gas piping
- c. The fuel gas piping safety shut-off valves

3.1.1.2 BOILER TRIM AND CONTROL EQUIPMENT: Provided the following boiler trim and control equipment:

- a. Boiler Controls.
- b. Combustion Regulator.
- c. High Temperature Limit Switch.
- d. Low Water Level Cutoff Switch.
- e. Boiler Safety Control Circuits.
- f. Alarm Bell.
- g. Post-Combustion Purge.
- h. Emergency Disconnect.
- i. Boiler Trim.
- j. Safety Relief Valve.
- k. Pressure Gages.
- l. Thermometers.
- m. Drain Trapping.
- n. Air Vent Valve.

3.1.1.3 BOILER STACK AND ACCESSORIES

3.1.1.3.1 Stack: Provide boiler stack constructed of sheet steel.
Manufactured multi-wall stacks may be used.

3.1.1.3.2 Insulation: Insulate portion of stack located inside the building.
Insulation is not required for multi-wall stacks.

3.1.1.3.3 Supports: Provide stack supports, umbrella collar and cap, and
flue transition piece.

3.1.1.3.4 Stack Thermometer: Provide flue gas dial type thermometer mount in
flue gas outlet.

3.2 D3022 BOILER ROOM PIPING AND SPECIALTIES

See 3045.

3.3 D3023 AUXILIARY EQUIPMENT

3.3.1 STEAM TO HOT WATER CONVERTER

Provide steam to hot water converter as required for the application.

3.3.2 CONDENSATE RETURN UNITS

Provide [hexahedral floor-mounted][horizontal cylindrical stand-mounted]
[vertical cylindrical underground] receivers and duplex pump units.

3.3.3 N TUBE RADIATORS

Fin tube radiators shall be provided with copper tubes and aluminum fins.

3.3.4 [METER

[Rotary axial- turbine steam meter][Variable orifice steam meter.] [Steam meter shall be interfaced with building energy monitoring system.]]

3.4 D3024 INSULATION

Insulate and provide vapor barrier hot water equipment as suitable for the temperature and service.

4. D3030 COOLING GENERATING SYSTEMS

4.1 D3031 CHILLED WATER SYSTEMS

4.1.1 SYSTEM REQUIREMENTS

- a. Maximum supply chilled water temperature shall be [] degrees C ([] degrees F) in the chilled water distribution loop at all times. Chilled water reset is not allowed.
- b. Total system chilled water volume shall be a minimum of 7.5 liters per kW (7 gallons per ton) of cooling. Provide an insulated storage tank, if required, to meet this requirement.
- c. [Provide hydraulically decoupled piping/pumping (primary/secondary arrangement) chilled water loop arrangement. Provide adjustable frequency drives on secondary pumps.] or [Provide variable primary flow chilled water pumping system. Provide adjustable frequency drives on primary pumps.]

4.1.2 AIR-COOLED CHILLERS

- a. Air-cooled [rotary screw, slide valve modulation] [scroll] [reciprocating] type.
- b. Provide minimum of [] stages of unloading [and provide unit with hot gas bypass.]
- c. Provide head pressure control for operation down to [] degrees C ([] degrees F).
- d. [Provide factory applied anti-corrosion coating for the condenser coils.] [Provide manufacturer's optional louvered covers or hail guards for condenser coils.]
- e. [Provide heat recovery from the chiller to supplement the reheat requirements of the outside air handling unit or for domestic water heating.]

4.1.3 WATER-COOLED CHILLERS

- a. [Centrifugal] [rotary screw, slide valve modulation], self-contained.
- b. [Provide a control interface for remote monitoring of the chiller's operating parameters, functions and alarms from the DDC control system's central workstation.] [Provide a central plant controller supplied by the chiller manufacturer to coordinate staging of the chillers and overall plant operation.]

4.1.4 CHILLED WATER EQUIPMENT INSULATION

Insulate and provide vapor barrier chilled water equipment as suitable for the temperature and service.

4.1.5 COOLING TOWERS

- a. Constructed of [galvanized steel with stainless steel basin] [stainless steel] [fiberglass] with fill material of PVC formed sheets. Provide stainless steel hardware.
- b. Provide [2-speed] [adjustable frequency drive] fan motors.

4.2 D3032 DIRECT EXPANSION SYSTEMS

4.2.1 DIRECT EXPANSION EQUIPMENT

Direct Expansion equipment with [air cooled] [water cooled] condenser. Provide equipment outdoor coils constructed of [copper fins and copper tubes] [aluminum fins and copper tubes with factory applied anti-corrosion coating.] [Provide louvered covers or optional hail guard on condensing units.]

5. D3040 DISTRIBUTION SYSTEMS

5.1 D3041 AIR DISTRIBUTION SYSTEMS

5.1.1 AIR HANDLING EQUIPMENT

Provide certified fans with AMCA seal. Provide nominal 2 mesh, 1.60 mm (1/16 inch) wire diameter bird screens for outdoor inlets and outlets.

5.1.1.1 CENTRAL STATION AIR HANDLERS

- a. Provide modular construction, double wall air handling units. Provide ARI certified fans and coils. [Provide an economizer cycle for each air-handling unit.]
- b. [Provide fan motors with adjustable frequency drives (AFDs).]
- c. Ultraviolet Disinfections System

For central station air handling units provide a UVC (ultra violet c-band) disinfection system for mold, bacteria and odor control in each air handler that has a chilled water or DX cooling coil.

5.1.1.2 FAN-COIL UNITS

Provide factory assembled and tested [horizontal] [vertical] type fan coils, certified with ARI and UL seal with the following factory fabricated and assembled items:

- a. Fan coil units shall have [4-pipe] [2-pipe] coil arrangement with [separate heating and cooling coils]
- b. [Provide 3-speed fan control.]
- c. [Provide for DDC system for control and monitoring of temperatures within each zone at the central workstation.]

5.1.1.3 VARIABLE AIR VOLUME (VAV) UNITS

Provide pressure-independent type ARI rated variable air volume units. [Provide each box with a hot water coil.] [Provide each box with an electric heating coil.]

5.1.1.4 DX VARIABLE AIR VOLUME (VAV) UNITS

Direct expansion equipment shall be specifically designed and manufactured for VAV applications. [Provide duct mounted [hot water coil] [electric heating coil] for each zone.]

5.1.1.5 VARIABLE AIR VOLUME VAV FAN-POWERED UNITS

Provide pressure-independent parallel flow ARI rated and UL listed VAV fan-powered units. [Provide each box with a hot water coil.] [Provide each box with an electric heating coil.]

5.1.2 DUCTWORK AND ACCESSORIES

5.1.2.1 DUCTWORK

- a. Rigid Ductwork: Galvanized steel ductwork
- b. Flexible Ductwork and Connectors: Insulated flexible, UL listed.
- c. Duct lining shall meet ASTM standard.

5.1.2.2 DUCTWORK ACCESSORIES

- a. Air Distribution Devices: Provide factory-finished grilles, registers, and diffusers constructed of aluminum.
- b. Dampers: Provide manual volume dampers in each branch take-off from the main duct to control air quantity.
- c. Fire Dampers: Provide fire dampers with damper blade section that does not intrude into the air stream when in the open position.
- d. Smoke dampers.
- e. Louvers: Provide outdoor air intake and exhaust louvers of [powder-coated aluminum] [stainless steel] designed to prevent the entry of rain or snow.

5.1.2.3 DUCTWORK INSULATION

- a. Provide external thermal insulation for all ductwork. Provide insulation with factory applied all-purpose jacket with integral vapor barrier.

5.2 D3042 EXHAUST VENTILATION SYSTEMS

5.2.1 DUCTWORK AND ACCESSORIES

Same as D3041.

5.2.2 EXHAUST FANS

Fans shall be AMCA certified. [Fans located in attics, on roofs, or in other areas where access is limited shall be with means for verifying operation via the building DDC system.]

5.3 D3043 STEAM DISTRIBUTION SYSTEMS

[For Exterior Buried Steam systems see G3041.]

5.3.1 PIPE AND FITTINGS

- a. Steam piping shall be Schedule 40, black steel, electric-resistance welded or seamless.
- b. Condensate return piping shall be Schedule 80, black steel, electric-resistance welded or seamless. At pressures less than 105 kPa (15 PSI), copper tubing may be used.
- c. Steel Pipe Fittings: For piping 50 mm (2 inch) and smaller, provide malleable iron screwed fittings or socket welding or threaded type. Provide butt-welding fittings or flanged type for piping 63 mm (2-1/2 inch) and larger.
- d. Insulate steam and condensate return piping with mineral fiber or cellular glass insulation with all-purpose jacket.
- e. Provide piping Identification.
- f. Provide pipe sleeves at each wall and floor penetration.

5.3.2 VALVES AND RELATED EQUIPMENT

- a. Provide appropriately sized valves as necessary to balance flows and/or isolate equipment for service and repairs, or as otherwise required by building codes.
- b. Provide steam pressure reducing stations.
- c. Provide appropriately sized steam traps, air trap, flask tank and other accessories where required.
- d. Provide pressure gages and thermometers.
- e. Provide strainer with cast steel or bronze.

5.4 D3044 HOT WATER DISTRIBUTION

Same as D3045. [For exterior buried Hot Water Distribution Systems see G3043.]

5.5 D3045 CHILLED WATER DISTRIBUTION

5.5.1 PUMPS

- a. Provide centrifugal circulating pumps.
- b. [Provide pump motors with adjustable frequency drive (AFD).]

5.5.2 PIPING

- a. Aboveground Piping: Electric resistance welded or seamless Schedule 40 black steel pipe. Piping 100 mm (4 inch) and smaller may be copper, depending on design pressure and temperature.
- b. Underground Chilled Water Piping: See G3051. Underground Hot Water Piping: See G3043.
- c. Aboveground Condenser Water Piping: Electric resistance welded or seamless Schedule 40 black steel pipe. Piping 100 mm (4 inch) and smaller may be copper, depending on design pressure and temperature.

- d. Provide piping Identification.
- e. Provide pipe sleeves at each wall and floor penetration.

5.5.3 FITTINGS

- a. Steel Pipe Fittings: For piping 50 mm (2 inch) and smaller, provide malleable iron screwed fittings or socket welding (Class 3000) or threaded type (Class 2000). Provide butt-welding fittings or flanged type for piping 63 mm (2-1/2 inch) and larger. [Grooved joint pipe coupling systems of appropriate pressure rating are acceptable in lieu of welded or screwed fittings.]
- b. Copper Fittings: Provide cast bronze solder joint type or wrought copper solder joint type.
- c. Dielectric Fittings: Provide between different materials.

5.5.4 PIPING AND EQUIPMENT INSULATION

- a. Below ground chilled water piping shall be factory fabricated, pre-insulated.
- b. Insulate above ground chilled water piping with cellular glass. Provide all-purpose jacket.
- c. Insulate hot water piping with mineral fiber, with factory-applied all-purpose jacket.
- d. For hydronic piping located outside the building, provide an [aluminum]or [stainless steel] jacket.
- e. Provide mineral fiber insulation with vapor barrier on all aboveground condenser water piping for cooling towers.
- f. Insulate pumps used for hot service with preformed mineral fiber insulation and pumps used for chilled water service with thick flexible unicellular insulation.

5.5.5 VALVES AND RELATED EQUIPMENT

- a. Provide appropriately sized valves as necessary to balance water flows and/or isolate equipment for service and repairs, or as otherwise required by building codes.
- b. Provide appurtenances such as air separators, expansion tanks, suction diffusers, strainers, etc. for chilled and hot water systems.
- c. Provide test ports in piping at inlet and outlet of all major system components including chillers, pumps, etc.
- d. Provide pressure gages and thermometers.
- e. Provide duplex basket strainer with cast steel, bronze, or cast iron body and quick open top.

5.5.6 AIR CONTROL AND CHEMICAL TREATMENT

- a. Air Separators: ASME rated.
- b. Expansion Tanks: ASME rated.

- c. Chemical Treatment: Provide chilled and hot water systems with chemical treatment for the control of pH, scale formation, and corrosion inhibition.
- d. Provide Makeup Water Station reduced pressure backflow preventer.
- e. [Glycol Makeup Station: Provide a [automatic] glycol makeup system to maintain system proper operating mixture.]

5.5.7 SYSTEM FLUSHING

Thoroughly flush hydronic systems prior to system startup.

5.6 D3046 CHANGE-OVER DISTRIBUTION SYSTEM

[Text to be developed.]

6. D3050 TERMINAL AND PACKAGE UNITS

6.1 D3051 TERMINAL SELF-CONTAINED UNITS

6.2.1 Air-To-Air Heat Pumps

Heat pump unit shall low noise, ARI rated and UL listed. [Provide with supplemental electric heat strips.] [Provide factory applied anti-corrosion coating on condenser coils.]

6.2 D3052 PACKAGE UNITS

6.2.1 Split System Air-To-Air Heat Pumps

Provide air-cooled, split system heat pumps with ducted air distribution for each space [or room module]. [Provide supplemental electric heat strips in air handlers.] [Provide factory applied anti-corrosion coating for the condenser coils] [Provide louvered covers or optional hail guard on condensing units to provide protection against vandalism, debris, or hail.]

6.2.2 Closed Loop Ground Coupled Heat Pumps

- a. Closed Loop Ground Coupled Heat Pumps shall be ARI rated.
- b. Ground coupled piping shall be High Density Polyethylene. Polyethylene Fittings shall be socket fittings or molded butt-fusion fittings.

6.2.3 Computer Room Air Conditioning Units

Computer room air conditioning units shall consist of computer room air handling units with [direct expansion cooling coils and remote air-cooled condensers][chilled water coils][hot water coils][electric resistance heating coils]. [Provide condensate water overflow, clogged filter sensors and alarms.] [A control interface shall be provided to allow for remote monitoring of the unit functions, alarms and room conditions from the DDC control system's central workstation.] Computer room air conditioning systems shall be capable of operation to [_____] degrees C ([_____] degrees F).

6.2.4 100% Outside Air Makeup Air Units

Provide factory packaged combination heating and cooling units, specifically designed to condition (cool, dehumidify, and/or heat) 100% outdoor air at the conditions indicated. [Provide factory applied anti-corrosion coating on both the condenser and evaporator coils to protect against salt air damage.] . .

6.2.5 Gas-Fired Unit Heater

ANSI and AGA label. Provide thermostats [and/or time clock].

6.2.6 Hot Water Unit Heaters

- a. ASHRAE tested and UL listed.
- b. Hot water piping- Same as D3045

7. D3060 CONTROLS AND INSTRUMENTATION

- a. Provide a direct digital control (DDC) system. [DDC System communication protocol shall be (make/model). Notwithstanding any other provisions of this contract, no other product will be acceptable. Pneumatics are not allowed.
- b. [Central control will be provided via a [Desktop] [Laptop] workstation computer.]
- c. [Provide a 475 mm (19 inch) diagonal measurement monitor, a keyboard, a mouse, a laser or inkjet printer capable of printing 600 dpi, and a 110-volt terminal strip with surge protection for both power and phone connections.]
- d. Workstation software shall be graphic-based and shall permit control, monitoring and troubleshooting of the DDC system.
- e. Provide panel mounted displays and keypads connected to each digital controller to communicate/program with the digital controllers.

7.1 D3061 HEATING GENERATING SYSTEMS CONTROLS

7.1.1 BOILER

At a minimum, the DDC system shall monitor and control points associate with boiler listed in the SWDIV Section D3000TG, D3061.

7.2 D3062 COOLING GENERATING SYSTEMS CONTROLS

7.2.1 CHILLER

Enabling and disabling of the chiller shall be by the central control system. [A master chiller control panel provided by the chiller manufacturer shall control multiple chillers. DDC interface with the chillers shall be via this panel.]

7.2.2 CHILLER INPUT/OUTPUT POINTS

At a minimum, the DDC system shall monitor and control the points associated with the chilled water system listed in the SWDIV Section D3000TG, D3062

7.3 D3063 HEATING/COOLING AIR HANDLING UNITS CONTROLS

7.3.1 AIR DISTRIBUTION SYSTEM INPUT/OUTPUT POINTS

- a. At a minimum, the DDC system shall monitor and control the following points associated with each air distribution system listed in the SWDIV Section D3000TG, D3063.

- b. For VAV systems, the DDC system shall monitor and control the following points associated with the VAV systems listed in the SWDIV Section D3000TG, D3063.

7.4 D3064 EXHAUST & VENTILATING CONTROLS

[Text to be developed.]

7.5 D3065 HOODS AND EXHAUST SYSTEMS CONTROLS

[Text to be developed.]

7.6 D3066 TERMINAL DEVICE CONTROLS

[Text to be developed.]

7.7 D3067 ENERGY MONITORING & CONTROL

Central DDC system shall be capable of recording, trending and graphing data HVAC systems including calculated energy consumption, [building electrical meter] and [building water meter]

7.8 D3068 BUILDING AUTOMATION SYSTEMS

[Text to be developed.]

7.9 D3069 OTHER CONTROLS & INSTRUMENTATION

7.9.1 Adjustable Frequency Drives (AFDs)

- a. Provide factory-assembled adjustable frequency drive control systems for variable speed control.
- b. Provide the accessories and other requirements listed in the SWDIV Section D3000TG, D3069.

8. D3070 SYSTEMS TESTING AND BALANCING

8.1 D3071 PIPING SYSTEM TESTING & BALANCING

Same as D3072.

8.2 D3072 AIR SYSTEMS TESTING & BALANCING

8.2.1 TESTING AND TRAINING

Accomplish testing of HVAC systems and their controls and training of personnel.

8.2.2 TRAINING

Conduct a minimum of (1) one-day training sessions and [(1) two-day training session].

8.2.3 HVAC SYSTEMS TESTING, ADJUSTING, AND BALANCING

- a. Perform duct air leakage testing for ducts of pressure class 0.75 kPa (3.0 inches water gage) and greater.
- b. Completely check out and correct any deficiencies noted in HVAC equipment, ductwork, and controls.
- c. Perform testing adjusting. And balancing of the HVAC system. The Test and Balance (TAB) Agency supervisor shall review project specifications and drawings.

- d. TAB Agency supervisor to submit all Design/Construction deficiency notifications directly to the Contracting Officer
- e. Noise levels shall comply with the requirements for [hotels and motels] [_____] per ASHRAE and additional requirements in SECTION D3000TG, D3072.

8.2.4 PERFORMANCE TEST

Upon completion of the installation and field testing, noise test, performance test and balance all systems to provide the air volume [and water] flow quantities indicated and maximum sound levels allowed.

8.2.5 AGENCY QUALIFICATIONS

The Contractor, as part of this contract, shall obtain the services of a qualified testing organization to perform the testing and balancing work as herein specified.

8.2.6 CERTIFIED REPORTS

Submit three copies of the test and balance report, covering air [and water system] performance, and sound pressure levels to the Contracting Officer prior to final inspection.

8.2.7 QUALITY ASSURANCE FOR FIELD TAB WORK

Conduct tests to demonstrate that capacities and general performance of air [and water] systems comply with the contract requirements.

8.2.8 HVAC SYSTEM PERFORMANCE VERIFICATION TEST

Conduct performance verification tests in the presence of a representative of the Contracting Officer to demonstrate maintenance of setpoints, the execution of operational sequences, and control loop stability and accuracy. The Contracting Officer will select up to 25 percent of the total number of reported data entries tabulated in the Certified TAB Report for recheck. [Coordinate the Performance Verification Test with the project Commissioning Agent. See D3073.]

8.3 D3073 HVAC COMMISSIONING

- a. Commission the HVAC systems per the Commissioning Plan of this section.
- b. After acceptance by the Contracting Officer, modify OMSI manuals as required, including providing all Commissioning Reports, and submit the Final OMSI manuals per the requirements of Section 01782, "Operation and Maintenance Data".
- c. Develop and submit a [Level 1] [Level 2] [Level 3] Commissioning Plan per the SMACNA HVAC Commissioning Manual to define the on-site activities for commissioning the HVAC systems

8.4 D3079 OTHER SYSTEMS TESTING AND BALANCING

[Text to be developed.]

9. D3090 OTHER HVAC SYSTEMS AND EQUIPMENT

9.1 D3091 SPECIAL SYSTEMS & DEVICES

9.1.1 ENERGY RECOVERY WHEELS

Provide total energy (enthalpy) type energy recovery wheels (heat wheels). Media shall be aluminum or a lightweight polymer coated with a corrosion-resistant finish.

9.1.2 HEAT PIPES

Provide factory fabricated, assembled and tested heat pipes with counter-flow arrangement.

9.2 D3092 SPECIAL HUMIDITY CONTROL

[Text to be developed.]

9.3 D3093 DUST & FUME COLLECTORS

[Text to be developed.]

9.4 D3094 AIR CURTAINS

[Text to be developed.]

9.5 D3095 AIR PURIFIERS

[Text to be developed.]

9.6 D3096 PAINT SPRAY BOOTH VENTILATION

[Text to be developed.]

9.7 D3097 GENERAL CONSTRUCTION ITEMS (HVAC)

9.7.1 ANTI-TERRORISM PROTECTION FOR MECHANICAL SYSTEMS: Conform with the anti-terrorism protection requirements described in the SWDIV SECTION D3000TG, D3097.

-- End of Section --